

REMARKS

This application was originally filed with Claims 1-46. Such claims were subject to restriction requirement. Claims 1-28 (Group I) were elected and Claims 29-46 were withdrawn from consideration.

In the Office Action, Claims 1-28 are rejected. Acknowledgement is also made of a claim for domestic priority under 35 U.S.C. § 120 and/or 121.

SPECIFICATION

The specification was objected to on the basis that reference to the priority application should be updated at Page 1, Line 2, to include the U.S. Patent Number of that priority application. Applicants have amended the specification according to the Examiner's suggestions and have further updated the priority data to correspond to the Application Data Sheet and the updated Official Filing Receipt. Therefore, reconsideration and withdrawal of this objection are respectfully requested.

CLAIM OBJECTIONS

Claim 12 is objected to on the basis of the word "first" being unnecessary since there is no "second" referenced anywhere in the claim. Applicants have amended Claim 12 according to the Examiner's suggestions. Therefore, reconsideration and withdrawal of this objection are respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

I. Claims 1-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hora et al. (U.S. Pat. No. 4,199,685) in combination with JP 6-79141. The basis of the rejection is that Hora teaches a method for separating isotopes comprising directing a first laser pulse to a target, and directing a second laser pulse into a plasma and then depositing separated species onto a substrate. This rejection is based on Hora, Column 6, Lines 6-17.

It is respectfully submitted that Hora, Column 6, Lines 6-17 does not show directing a second laser pulse into a plasma for causing spatial separation. It is not seen that Hora uses second pulse directed to a plasma. Hora, Column 6, Lines 6-17 describes as follows:

A laser beam is generated from a single-mode quality and a Gaussian density profile of one pulse of preferably 1 to 50 picoseconds (10^{-12} to 5×10^{-11} seconds) but possibly 100 picosecond duration and of 10^{-4} to 100 Joule energy of wavelength between 300μ and 0.01μ where $\mu=10^{-6}$ meters. A sequence of such pulses with a frequency of 10^6 per second or more should be provided. Each pulse produces energetic multi-charged ions as discussed above. If the target T is a high Z material, the generated plasma will be split into several groups of ions with constant Z and very low temperature (less than 1000 eV).

The passage indicates that a laser beam is generated and a series of pulses is provided where each pulse produces the charged ions. This is simply a case where respective pulses impinge on the target to provide respective groups of separate ions.

In other words, Hora et al. teaches generating a pulse and impinging a target to generate a plasma that splits into groups of ions. This process may be conducted a

desired number of times. However, in each case, a single pulse is impinged on a target. There is no subsequent pulse directed to a plasma.

Hora is different from independent Claim 1 of the present invention, where a first pulse is directed to a target to generate a plasma comprising ionized species and causing spatial separation, and then a second pulse is directed into the plasma to further spatially separate.

Thus, an important and critical difference between Hora et al. and the present invention is that in the present invention the second pulse is directed into the plasma. In contrast, in Hora, a subsequent pulse is directed to the target.

A further difference between Hora et al. and the present invention is that Hora generates charged species emitted from a laser-activated source and then utilizes a magnetic field or combination of electric and magnetic field to cause the separation. See Hora et al., Column 5, Line 49 - Column 6, Line 17. Here it is described that charged species are separated by external-applied fields using a separate apparatus generating a magnetic field or combined electric and magnetic field. Hora uses a separate external field generator to create the separation field. See also Hora et al. at Column 1, Lines 10-25, wherein it is described that charged ions are produced and accelerated within a relatively cold plasma and the separation of mixed isotopes is accomplished by electric and magnetic fields applied by conventional field generating apparatus and methods.

To further distinguish from Hora et al., a limitation has been added to Claim 1 defining that the laser pulse generates a plasma and generates "an internal electromagnetic scattering field causing spatial separation of said ionized isotopic

species". Clearly in the present invention the spatial separation is accomplished by generating an internal electromagnetic scattering field via laser pulse alone. Thus, importantly, apparatus and methods imposing an external field are not required.

Support for the amendment to the independent claims concerning "internal electromagnetic scattering field causing spatial separation" can be found in the specification at least at Paragraphs [0013], [0014] and [0128]-[0143] containing reference to generating the plasma comprising ionized isotopic species and to generate an internal electromagnetic scattering field within the plasma causing spatial separation of the ionized isotopic species.

JP 6-79141 (JP'141) does not supply deficiencies of Hora et al. since JP '141 is directed towards isotopes separation in a manner essentially the same as Hora, whereby a laser beam is used to vaporize material forming isotopes and an external electric field is applied to the plasma to cause separation.

The commercial advantages of Applicants' claimed invention stem, to a large degree, from the ability to achieve isotope separation without application of an external magnetic field. Also, Applicants claimed invention is further commercially advantageous in its ability to achieve isotope separation of a target material: (1) without a separate preceding step of generating a vapor as suggested in both Hora et al. and JP'141: and (2) without the necessity of imposing an external field to cause the separation.

Claims 2-11 depend directly or indirectly from Claim 1, and are submitted to be patentable for the reasons given with respect to Claim 1.

II. Claims 12-22 are also rejected under 35 U.S.C. § 103(a) as being unpatentable over Hora et al. in combination with JP 6-79141 (JP'141). The basis of

this rejection is that Hora and JP'141 are as applied for the reasons described in the rejection of Claims 1-11.

Claim 12 has been amended to include limitation as in Claim 1, further distinguishing the present invention from Hora and JP'141 to state that a laser pulse is directed to a target "at an energy fluence sufficient to generate a plasma comprising ionized isotopic species and to generate an internal electromagnetic scattering field causing spatial separation of said ionized isotopic species."

For the reasons described herein with respect to Claim 1 above, Claim 12 is not rendered obvious by Hora et al. in combination with JP'141.

Claims 13-22 depend directly or indirectly from Claim 12, and are submitted to be patentable over Hora and JP'141 for the reasons given with respect to Claim 12.

III. Claims 23-28 are also rejected under 35 U.S.C. § 103(a) as being unpatentable over Hora et al. in combination with JP 6-79141 (JP'141). The basis of this rejection is that Hora and JP'141 are as applied for the reasons described in the rejection of Claims 12-22 and as further incorporating the basis of the rejection of Claims 1-11, essentially all being identical rejections.

Claim 23 has been amended to include limitation as in Claims 1 and 12, further distinguishing the present invention from Hora and JP'141 to state that a laser beam has "an energy fluence sufficient to generate an internal electromagnetic scattering field causing spatial separation of said ionized isotopic species."

For the reasons described herein with respect to Claims 1 and 12 above, Claim 23 is not rendered obvious by HOra et al. in combination with JP'141.

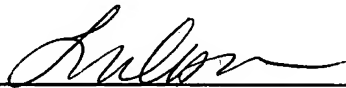
Claims 24-28 depend directly or indirectly from Claim 23 and are submitted to be patentable over HOra and JP'141 for the reasons given with respect to Claim 23.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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